

Appl. No. 10/740,076
Amdt. dated February 3, 2006
Reply to Office Action of August 4, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (original). A catalyst for carbon oxide methanation reactions for fuel cells comprising a metal capable of forming a metal-carbonyl species on a support having a predetermined pore size of sufficient dimensions to allow the pore to accommodate a fully carbonylated metal complex.

Claim 2 (original). The catalyst of Claim 1 wherein the support is a crystalline aluminosilicate.

Claim 3 (original). The catalyst of Claim 1 wherein the support is selected from the group consisting of a molecular sieve, beta-zeolite, mordenite, faujasite, any other aluminosilicate with a regular lattice structure, alumina, titania, ceria, zirconia and combinations thereof.

Claim 4 (original). The catalyst of Claim 3 wherein the support is selected from the group consisting of a beta-zeolite, mordenite, and faujasite.

Claim 5 (original). The catalyst of Claim 1 wherein the metal is selected from the group consisting of ruthenium, rhodium, platinum, palladium, rhenium, nickel, iron, cobalt, lead, tin, silver, iridium, gold, copper, manganese, zinc, zirconium, molybdenum, other metals that form a metal-carbonyl species and combinations thereof.

Claim 6 (original). The catalyst of Claim 5 wherein the metal is selected from the group consisting of ruthenium, rhodium and nickel.

Claim 7 (original). The catalyst of Claim 6 wherein the metal is ruthenium.

Claim 8 (original). The catalyst of Claim 1 further comprising an inert binder.

Claim 9 (original). The catalyst of Claim 8 wherein the binder is selected from the group consisting of alumina, γ -Al₂O₃, SiO₂, ZrO₂, TiO₂ or pseudo-boehmite.

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Claim 10 (original). The catalyst of Claim 1 wherein the metal is added to the support through impregnation, incipient wetness method, immersion and spraying.

Claim 11 (original). The catalyst of Claim 7 wherein the ruthenium is added to the support through impregnation.

Claim 12 (original). The catalyst of Claim 4 wherein the support has a pore volume in the range of from about 0.3cm³/g to about 1.0cm³/g.

Claim 13 (original). The catalyst of Claim 12 wherein the metal is ruthenium impregnated on the support so as to deliver a concentration of from about 0.5 wt% Ru to about 4.5 wt% Ru, based on the total weight of the catalyst including the ruthenium.

Claim 14 (original). A catalyst for carbon oxide methanation reactions for fuel cells comprising a metal capable of forming a metal-carbonyl species on a support having a pore volume in the range of from about 0.3cm³/g to about 1.0cm³/g.

Claim 15 (original). The catalyst of Claim 14 wherein the support is selected from the group consisting of a crystalline alumino-silicate, a molecular sieve, beta-zeolite, mordenite, faujasite, any other alumino-silicate with a regular lattice structure, alumina, titania, ceria, zirconia and combinations thereof.

Claim 16 (original). The catalyst of Claim 14 wherein the metal is selected from the group consisting of ruthenium, rhodium, platinum, palladium, rhenium, nickel, iron, cobalt, lead, tin, silver, iridium, gold, copper, manganese, zinc, zirconium, molybdenum, other metals that form a metal-carbonyl species and combinations thereof.

Claim 17 (original). The catalyst of Claim 14 further comprising an inert binder.

Claim 18 (original). The catalyst of Claim 17 wherein the binder is selected from the group consisting of alumina, γ -Al₂O₃, SiO₂, ZrO₂, TiO₂ or pseudo-boehmite.

Claim 19 (original). The catalyst of Claim 14 wherein the metal is ruthenium impregnated on the support so as to deliver a concentration of from about 0.5 wt% Ru to about 4.5 wt% Ru, based on the total weight of the catalyst including the ruthenium.

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Claim 20 (original). A catalyst for carbon oxide methanation reactions for fuel cells comprising a metal selected from the group consisting of ruthenium, rhodium, platinum, palladium, rhenium, nickel, iron, cobalt, lead, tin, silver, iridium, gold, copper, manganese, zinc, zirconium, molybdenum, other metals that form a metal-carbonyl species and combinations thereof on a support having a pore volume in the range of from about $0.3\text{cm}^3/\text{g}$ to about $1.0\text{cm}^3/\text{g}$, wherein the support is selected from the group consisting of a crystalline alumino-silicate, a molecular sieve, beta-zeolite, mordenite, faujasite, any other alumino-silicate with a regular lattice structure, alumina, titania, ceria, zirconia and combinations thereof.

Claim 21 (original). The catalyst of Claim 20 further comprising a binder selected from the group consisting of alumina, $\gamma\text{-Al}_2\text{O}_3$, SiO_2 , ZrO_2 , TiO_2 or pseudo-boehmite.

Claim 22 (original). The catalyst of Claim 20 wherein the metal is ruthenium impregnated on the support so as to deliver a concentration of from about 0.5 wt% Ru to about 4.5 wt% Ru, based on the total weight of the catalyst including the ruthenium.

Claim 23 (original). A catalyst for carbon oxide methanation reactions for fuel cells comprising ruthenium impregnated on the support so as to deliver a concentration of from about 0.5 wt% Ru to about 4.5 wt% Ru, based on the total weight of the catalyst including the ruthenium, wherein the support is selected from the group consisting of a beta-zeolite, mordenite and faujasite.

Claim 24 (original). The catalyst of Claim 23 wherein the support has a pore diameter of greater than about 6.3\AA and a pore volume in the range of from about $0.3\text{cm}^3/\text{g}$ to about $1.0\text{cm}^3/\text{g}$.

Claim 25 (original). The catalyst of Claim 23 wherein the catalyst further comprises the binder $\gamma\text{-Al}_2\text{O}_3$ at a loading of about 20 wt%, including the weight of the binder.

Claim 26 (withdrawn). ~~A method for carbon oxide methanation reactions for fuel cells using a catalyst comprising a metal capable of forming a metal-carbonyl species on a support having a predetermined pore size of sufficient dimensions to allow the pore to accommodate a fully carbonylated metal complex, the method comprising passing a mixture of gases over the catalyst in a reaction zone having a temperature below the temperature at which the shift reaction occurs and above the temperature at which the selective methanation of carbon monoxide occurs.~~